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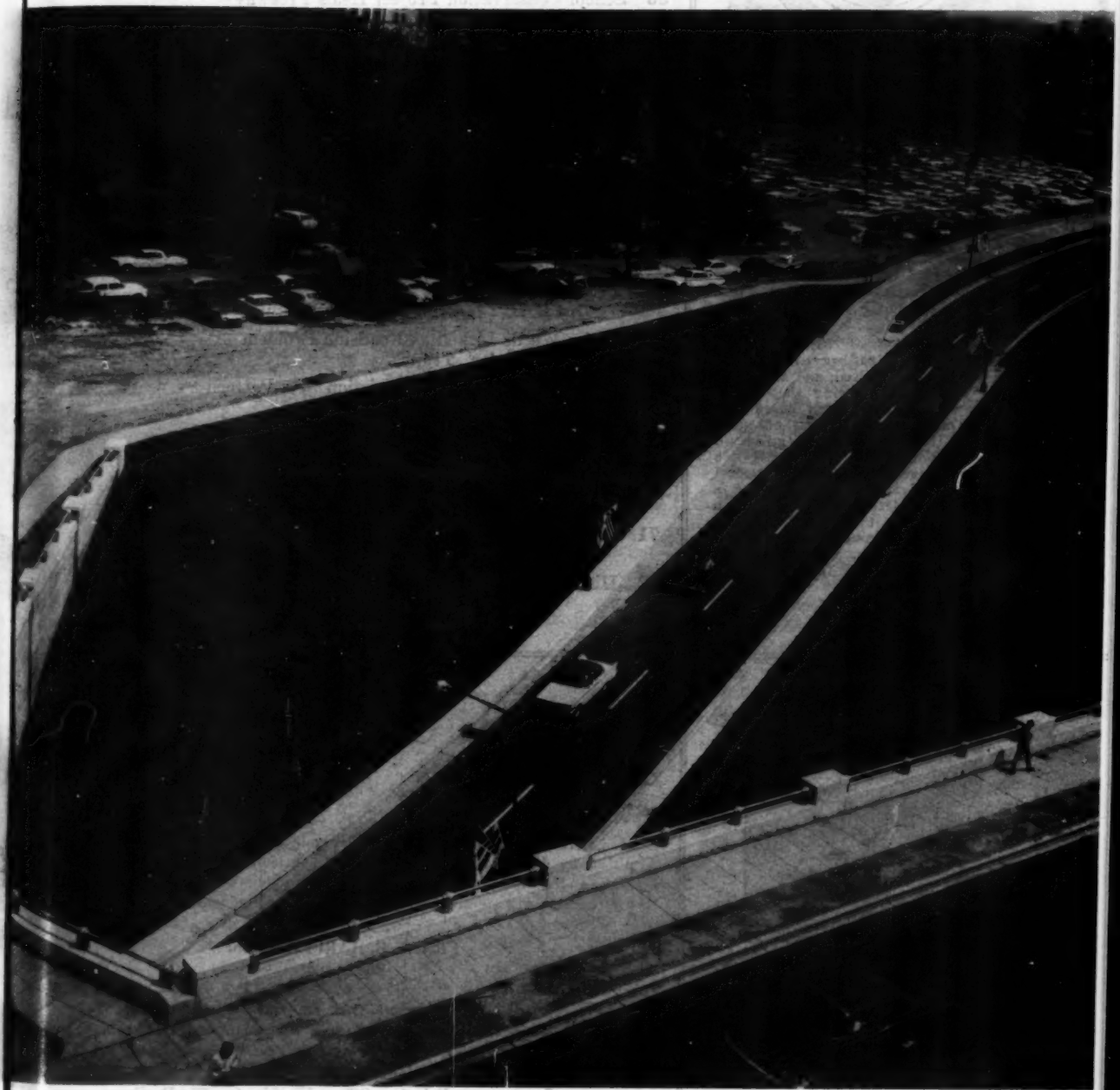
TECHNOLOGY & SCIENCE

Soil Conservation



SOIL CONSERVATION SERVICE • U. S. DEPARTMENT OF AGRICULTURE

VOL. XXVIII, NO. 3 OCTOBER 196?

Growth Through Agricultural Progress

Soil Conservation 25 Years Ago

"In the Soil Conservation Service program, a proper water distribution system with a minimum of 'waste' water is surveyed by the engineers and constructed by the cooperator. This compares with the installation of contour-tillage practices on farms dependent on precipitation for crop production in other projects . . .

"The prevention of 'sloughing off' of banks along drainageways has not yet been satisfactorily solved, and cannot be solved except by reducing the volume of the waste water which causes the gullies. Only conservative use of water will avoid the distressing damage caused by the surplus turned loose to seek a course to the sea. The irrigationist must learn the fundamental truth, that he is dealing with a destructive as well as a life-giving agent. It is possible to gage more correctly the amount of water required and thus prevent the accumulation of a surplus to destroy the neighboring landscape."

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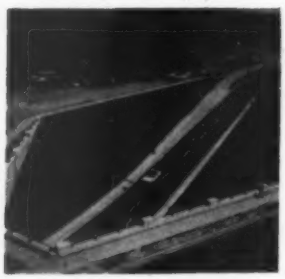

COVER PICTURE — (See page 59.)—Photo by Richard Evans.

Soil Conservation

ORVILLE L. FREEMAN
Secretary of Agriculture

DONALD A. WILLIAMS
Administrator, Soil Conservation Service

SOIL CONSERVATION is the official organ of the Soil Conservation Service, published by direction of the Secretary of Agriculture as administrative information required for proper transaction of the public business. The printing of this publication was approved by the Bureau of the Budget, June 26, 1958.

FRANK B. HARPER, Editor

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Federal and State Road Agencies Battle Erosion

By Robert T. Walker

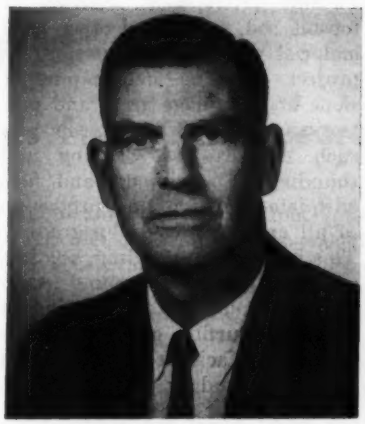
THE extent and importance of control of roadside erosion will be appreciated when it is realized that there are more than 866,000 miles of both rural and urban highways in the Federal-aid primary, secondary, and interstate highway systems. For example, on roadside areas of the 41,000 mile National System of Interstate and Defense Highways, it is anticipated that cost of soil stabilization by proper grading, drainage, and erosion-control methods, including special structures and materials, may approximate one-half billion dollars.

Under Federal-aid legislation, the States have the initiative in proposing roads to be improved and the type of improvement. The States prepare surveys, plans and specifications, let contracts, and supervise construction, subject to Public Roads approval.

The importance of protecting raw earth slopes against erosion has long been recognized by highway administrators. The extensiveness of soil stabilization on highway cuts and fills is difficult to estimate on a nationwide basis, because of wide variations in soils, topography and climate.

As early as 1933, the Bureau of Public Roads encouraged each State highway department to include roadside improvement work in its program of construction on the Federal-aid highway system. This work included elimination of construction scars, flattening and rounding of slopes, seeding and sodding, and related roadside improvements. Regulations provided that a minimum of 1 percent of the total amount allotted to each State be expended for roadside improvement work. Prior to World War II, all demonstration work for control of erosion and improvement of roadsides was carried out as a separate operation after a highway was built.

In 1936, cooperative demonstrations for the study of soil erosion along highways were initiated by the Bureau of Public Roads in cooperation with the Soil Conservation Service. The object of these cooperative demonstrations was to study methods and demonstrate practices, materials, structures, and plants best adapted for the prevention of erosion along highways under varying conditions of cross section, soil type, and climate, taking into consideration relative initial cost and subsequent maintenance. More than 70 cooperative soil erosion control projects were completed in over 20 States.



Robert T. Walker.

Such demonstration work was discontinued during the emergency period of World War II (1941-45), because of shortages in manpower, money, and materials; but, as a result of wartime conditions, erosion-control work was included as an integral part of construction in the grading and drainage of wartime access roads. Following World War II, Public Roads encouraged

Cut and fill slopes well-rounded and protected against erosion on this interstate controlled access highway west of Ridgeville, Md.

Note:—The author is landscape architect, U. S. Bureau of Public Roads, Washington, D. C.

the States to provide roadside improvement work as a part of original construction on Federal-aid projects, including:

Conservation and protection of natural landscape features, including trees, strips of woodland, springs, shorelines, and sites for wayside development. Salvage of topsoil, sod, stone, and other local material warranted for use on the project. Grading and shaping of slope and drainage areas and protecting them against erosion by such measures as warping and rounding of earth cuts and fills, adequate drainage, and protection of all areas disturbed by grading. This is done by topsoiling, seeding, sodding, mulching, ground cover and vine planting, riprapping of slopes; by turfing, paving, or other suitable surfacing on areas subject to erosion; and by providing vegetative or other protection.

On January 25, 1961, the American Association of State Highway Officials adopted and published "A Policy on Landscape Development for the National System of Interstate and Defense Highways." This policy emphasizes slope grading, drainage, and erosion control as closely related operations, and also the need for their consideration together in the design and construction of highways. Where unstable soil and slope conditions are especially critical, soil erosion on roadside areas, unless properly controlled, may create the movement of large earth masses such as landslides and threaten the safety and usefulness of the highway. Some projects may require special underdrainage and costly piping.

State highway department plans and specifications for Federal-aid projects provide for the conservation and protection of natural features where feasible. Native materials such as topsoil are salvaged and stockpiled for reuse. Most States require that available topsoil be disked or harrowed into cut slopes where conditions permit, to provide a favorable medium for planting.

Vegetative cover on highway cut and fill slopes is recognized generally as the most practical method of stabilizing soils and reducing erosion in climates favorable to plant growth, either by seeding or other vegetative methods. As a rule, Federal-aid highway construction contracts provide that seeding and mulching operations be performed as soon as possible after grading of slopes has been completed. However, structural methods such as cribbing, retaining walls, and riprapping may be justified where the use of vegetation would not be practical.

Modern equipment for tilling, soil preparation, seeding, and mulching provides the contractor with economical methods of establishing grass cover on roadside areas. The improvement of many State standard specifications in recent years provides the contractor with alternate methods of applying soil amendments, fertilizers, rates and mixtures of seed, and rates and variety of mulch and tie-down materials.

Machine spraying seed and fertilizer on roadside in West Virginia.

Where slope ratios are steep and equipment such as seed drills and fertilizer spreaders cannot operate effectively, spray types of equipment are used to distribute a mixture of seed and fertilizer in water. There is increasing interest in airblast equipment and the use of helicopters or light planes for seeding operations in large scale or on difficult terrain.

Cooperative efforts by various governmental agencies working with people in research and industry have made significant contributions in materials and methods toward controlling roadside soil erosion. Resulting new materials include wood pulp fiber, elastomeric polymer emulsions, jute mesh, paper fabric, glass fiber blankets, and a felt type blanket impregnated with fertilizer, organic material, insecticide, and specified seed. Some already are proving their value and are comparable costwise to straw or hay mulch.

The highway administrator is interested in successful seeding at the lowest cost. Through such cooperative research and the development and use of new materials and improved equipment, the cost per square yard of erosion control has

Mulch blower spreading straw on fill slope along U.S. 50 near Mitchellville, Md.

been reduced about 75 percent on highway cuts and fills in construction of extensive mileages of Federal-aid projects where modern machine methods are advantageous over hand labor and old types of equipment.

The Bureau of Public Roads likewise has cooperative agreements with 14 State highway departments for roadside research studies. State universities also are assisting in investigations of the establishment of vegetation, types and use of equipment, chemical weed control, and roadside maintenance and its effect on highway design and construction.

School Conservation Project

Heals—Beautifies Freeway Eyesore

By James S. Bennett

CLEVELAND is gradually getting a modern expressway system. Workers can live farther out and get there quicker. But probably nowhere in the country has urban sprawl moved in faster and left more scars on the landscape than in this Ohio area.

Bare banks and borrow pits have sprung up where, only a decade ago, cattle grazed on grass-covered slopes. Meanwhile, each year Cleveland dredges nearly a million cubic yards of sediment from its harbor—at a cost of $500,000.

One 4-acre eyesore, left when Route 21 Freeway was built, lay right along the school ground in suburban Cuyahoga Heights. But, thanks to conservation-minded school officials, motorists on the freeway now see a new landscaped area covered with grass and shrubs. Not only is the old eyesore gone, the school has in its place a brand new outdoor classroom and athletic field.

Conservation planning has begun moving back into suburban Cleveland. Even back in 1940, officials of Cuyahoga Heights School had sponsored tree planting on the school grounds. The trees now serve as an outdoor study area for biology students. But, at the outset, the question was whether this huge mound, with gullies up to 35 feet deep, could possibly be leveled and planted. The project not only would benefit Cuyahoga Heights School, but it would serve as an example of a well-planned erosion-control project that might help promote other needed conservation reclamation work.

Superintendent Robert C. Ray envisioned still other assets. The smoother part of the grounds, properly seeded, could serve as a practice football field, and possibly as a baseball field. Ray got in touch with the Soil Conservation Service through the Cuyahoga Soil Conservation District.

The soil type shown on the Service's soil survey maps indicated that the area would be difficult to control. Huge gullies bore out this discouraging prospect.

Through efforts of SCS State and area engineers, a water-disposal plan was worked out. It was significantly different from most such plans. Usually, it is enough for conservation diversison ditches to be seeded to grass; but these diversions would have to be paved with asphaltic concrete! Rather than empty into the customary sod waterway, they had to be emptied into corrugated pipe. Some surface water could be absorbed into the ground by use of good grass cover, but all excess would have to be "walked" off the slope.

The SCS took the suggested plan to Bill Sweeney, village engineer, who agreed to draw up a blueprint and supervise construction. The blueprint would list the kind of seed, fertilizer, and mulch to be

Note:—The author is area conservationist, Soil Conservation Service, Warren, Ohio.

Eroded "eyesore" before land grading and reseeding began.

Seeding Contractor Peter Muller in 35-ft. gully before land grading was done.

used on each individual area.

In 1961, the contract was ready to be let. Several contractors refused to enter a bid, realizing that this was a tremendous project. The rough grading went to an excavating company on a bid of $20,000, which included filling the gullies and regrading the entire area to a specified contour. The contractor used three large "pans," in addition to bulldozers and compacting equipment, to move 37,000 cubic yards of soil.

The installation of engineering practices, seeding, and mulching went to a horticultural firm at a cost of $24,585. This contractor used 120 tons of asphaltic concrete to line two diversion ditches which empty into 180 feet of corrugated steel pipe. He also spread 4 inches of topsoil over the practice football field. The seeding mixture consisted of creeping red and Kentucky 31 tall fescue, Kentucky bluegrass, perennial ryegrass, and sweetclover. A half ton of seed, 4 tons of fertilizer, and 10 tons of straw mulch were used.

School officials planted trees and shrubs in designated areas, to provide food and cover for insect-eating birds and animals. The entire school grounds will serve as an arboretum where students can study soil, water, and wildlife conservation. The project is a step forward toward a soil and water conservation plan that the school will carry out in cooperation with the Cuyahoga district.

Housing developments, shopping plazas, and new highways around Cleveland are contributing to an ever-increasing problem. Each year more and more urban residents are asking the SCS for help with erosion problems. Much of the agricultural land in the county is well protected. Most of the erosion is

Supt. Ray (r.) and Duane Bosworth of SCS examining one of 8-ft. asphalt diversion ditches.

caused by urbanization activities.

City and county planning commissions, county commissioners, village officials, and schools—all who control unprotected urban land—need to plan proper water-disposal systems for all land developments. This might include water-conservation reservoirs that will hold water for future use. It is becoming more evident that a conservation plan is needed on all land, both urban and rural, if highway and housing construction and related soil and water conservation problems are to be licked.

VIPs FOR ROADSIDE IMPROVEMENT

By Bernhard A. Roth

NO plants at the moment are more important to the Connecticut Highway Department than a few dozen very-special shrubs growing timidly but surely on selected embankments along the Constitution State's interstate highway system. The Department calls them VIPs—"very important plants."

Their slender, woody shoots groping toward the sun were started directly from seed, rather than from the usual plantings of 15- to 18-inch nursery stock. If the plants thrive, a new era in highway vegetation and maintenance may begin. If they don't, chief mourners will be William C. Greene, landscape engineer for the State Highway Department, and Wilson O. Hill, plant materials specialist for the Soil Conservation Service.

Several years have elapsed since the Connecticut Highway Department and the SCS got together. Their mutual aim has been to select native shrubs and direct-seeding techniques that will be useful on the long miles of road between towns and highway interchanges. Functional plantings from nursery stock will continue to enhance rights-of-way through communities. They will also serve special pur-

Note:—The author is field information specialist, Soil Conservation Service, Upper Darby, Pa.

poses, such as driver-visibility and road-outlining at access points.

In the meantime, a successful, direct shrub-seeding program could chop an immense slice off Connecticut's current road-scaping costs. Greene puts a value of $1 to $5 on each woody plant growing by the wayside; and $12,000 to $25,000 for each running mile of highroad successfully grassed and shrubbed. Close to 300 miles are embraced in the State's expanding interstate work alone. Fractional savings to the mile would add up to a startling figure.

The Soil Conservation Service has been searching out new plants and planting techniques to protect soil for more than a quarter of a century. The agency's backlog included getting things to grow on such improbable sites as the Dust Bowl, strip-mine spoil, and sand dunes all over the country. Here would be a chance to experience a new twist in revegetation.

Disaster befell an initial fall seeding of trial shrubs. A heavy winter melt-off of snow and ice ripped through the test bankings, taking most of the seed with it. The next spring and fall, Connecticut highway personnel and SCS technician Hill doggedly repeated their experimental seedings, bearing in mind that germinating and growing most shrubs is a 3- or 4-year undertaking.

On an April morning recently, landscapers and conservationists could utter a few restrained huzzahs. Crawling up and down several test plots while puzzled motorists whizzed by, they singled out first one skinny shoot—then another—and another. They were survivors of the ill-starred washout! Thus did two species of rose —*wichura* and *multiflora*—join the elite of Connecticut's "very important plants." They are doing nicely.

Greene and Hill have broadened their trials to include a score of common and native shrubs. Their thought is to have the countryside look as naturally wild and lovely as ever, after the roadbuilders have moved on. Mainly, they are working with species that New Englanders have known in their woods, farmlands, and backyards for centuries. In addition to roses, they are seeding sumacs, shrub, dogwoods, bush honeysuckles, bayberries, bush lespedezas, sweet fern, and viburnums.

Old-fashioned corn planter held by Landscape Engineer Wm. P. Greene of Connecticut Highway Dept. (r.) is one device used to spot-seed shrubs. Wilson O. Hill of SCS (l.).

Also being checked are several methods of direct seeding. If the plots grow as hoped, shrubs will occupy all areas being stabilized except an 8- to 10-foot grass border next to the pavement. It is hoped that woody vegetation will help reduce the highway mowing bill.

Minnesota and New Jersey highway departments also have in the past few months organized shrub-seeding activities.

Route 15 overpass roadbank near Rockville, Conn., newly direct-seeded with indigenous shrubs expected to supplant other vegetation.

◆

Stockwater ponds and erosion control or water-detention structures in many cases can be designed to provide secondary fish and wildlife benefits, without extra cost.

◆

An exposed soil profile, such as the side of an open pit, can be studied for past history and probable future changes in soil of the surrounding area.

◆

Erosion damage caused by runoff water from adjacent areas can be reduced by diversions and detention structures.

Roadbank Revolution

By Karl E. Graetz and C. H. Jent

COOPERATIVE roadbank stabilization projects have become a familiar sight to motorists on Tennessee's highways and byways from the Mississippi River to the Smokies. Green islands of kudzu, fescue, lovegrass, sericea, and native grasses dot the State's once predominantly bare road cuts.

This roadbank revolution in the Volunteer State is a result of a gradual bending of public opinion developed through conservation teaching. Bare roadbanks always have been taken for granted—a familiar part of the daily scene. Then, about 1957, the seriousness of roadbank erosion and unsightliness began to aggravate the public conscience.

Certainly much of the enthusiasm and initial drive behind the movement was inspired by soil conservation district supervisors and assisting Soil Conservation Service personnel. Most of the early projects were sponsored by the district supervisors. Groups such as the Garden Clubs, Future Farmers of America, Boy Scouts, and community and civic clubs were eager to make some tangible contribution.

Local highway department people contributed labor. Oftentimes, merchants and farmers donated fertilizer, straw for mulch, and the use of farm equipment. Through the Soil Conservation Service, new plants and techniques were made available for trial.

With guidance supplied by Service technicians, roadbank projects sprang up all over the State. In the 4 years beginning in 1957, plantings had been made in 42 of the 95 soil conservation districts. University of Tennessee agronomists and Service technicians have cooperated in evaluating the results of these plantings.

Some of the new plants tested failed entirely. Others, such as Indian grass, switchgrass, everlasting pea (*Lathyrus latifolia*), memorial rose (*Rosa wichuraiana*), and honeysuckle met with limited to good success on some sites. The use of tall fescue on roadbanks is limited to the better soil areas and to the main highways where extra management is feasible.

Bermudagrass did well on the deeper soils, especially west of the Tennessee River in the loess area; but it declined on the very poor banks, and fertilizer was needed to keep it going on the majority of sites. Crownvetch was slow to establish in Tennessee. However, after 2 or 3 years, many of the plantings continue to thicken, in the cooler areas.

After 2 years, the Service found that many of the plants under trial decreased or went out entirely. Droughty, infertile soil conditions on the slopes were too severe. Some of the best results were obtained from sericea lespedeza, lovegrass, kudzu, and certain native grasses, although both sericea and the native grasses were difficult to establish from seed when using conventional seeding methods.

In western Tennessee, the State Highway Department had been using hay of native plants mowed through the summer from along rights-of-way to mulch banks. No fertilizer was used, and the hay usually contained little seed. Although establishment of vegetation was slow, this is a practicable and economical practice; and many miles of roadbanks have been treated in this manner.

Soil Conservation Service technicians refined this method, by making selective cuttings of native bluestem hay (Virginia broomsedge, little bluestem, split beard-

McEwen FFA boys examine fescue sod they helped plant on roadbank the fall before.

Note:—The authors are, respectively, plant materials technician, Raleigh, N. C., and agronomist, Knoxville, Tenn., both of the Soil Conservation Service.

Ruritan Club members and others spread mulch on roadbank plot seedings on Highway 109 near Laguardo, Tenn.

grass, etc.) in the fall when the seed was ripe. The hay was applied as a mulch-covering on from 50 to 75 percent of the soil surface. In the spring, 600 to 800 pounds of 6-12-12 fertilizer was broadcast over the mulch, just before expected germination. Full stands resulted.

In order to overcome the difficulty in getting stands of sericea, the hay was mowed when in seed and applied to the back slopes as a mulch. Combine run, or unhulled, seed at 100 pounds an acre, and even hulled unscarified seed at 80 pounds to the acre, also was planted and mulched with grain straw, from the middle of October to mid-January.

Past experience with weeping lovegrass on roadbanks showed that stands thin out and become clumpy with age. However, the ease of establishing this grass and its quick production of summer cover are valuable assets. To take advantage of this trait lovegrass was used in combination with more dependable, but slower growing, plants. Sericea proved to be the best companion. Lovegrass gave quick protection, and as it faded, the sericea plants were released to take over.

Kudzu is a veteran roadbank conservation plant. What it can't grow in, it will grow over. It is particularly valuable on steep banks where seedings are impracticable. Kudzu always has been slow in producing complete cover, but observations confirmed that plants established in the sediment deposit near the ditch line outgrew all the others. As a result, basal plantings of kudzu were started in the spring of 1958 in the White County Soil Conservation District. This method produced dense cover on the lower slopes in 2 years, and this method of planting now is standard. A row of slower growing plants on the top of the bank to provide a few trailing vines for the lower plants to climb on is included.

The State Highway Department has cooperated on all the roadside plantings; and additional funds have been made available for purchasing materials and equipment for establishing vegetation on a large-scale basis. Now, many miles of State highways are being planted each year. Also, several county highway departments have done work toward vegetating road cuts. Several soil conservation districts have furnished mulch materials for large-scale plantings, enabling the Highway Department to accomplish more with limited funds.

At the request of the Department, the Soil Conservation Servvice and University of Tennessee agronomists made suggestions for revising its seeding specifications—planting dates, seed mixtures, fertilizer, and mulching rates.

Land and People Conferences

Strengthening and revitalizing rural America through rural areas development and conservation is the theme of five regional conferences on Land and People called by the U. S. Department of Agriculture in September and October. Farmers, businessmen, educators, civic and government leaders were invited to put forward their own proposals for insuring prosperity in their communities.

Secretary Orville L. Freeman named as a major objective of the conferences—an outgrowth of the National Land and People Conference in Washington last January —"to broaden public realization of the interdependence of rural and urban people, and the stake that city people have in the welfare of our rural land resources and the people and institutions that provide our Nation so bountifully with food and fiber."

The conference schedule:

Sept. 17-18—St. Louis, Mo. (Mich., Wis., Minn., Iowa, Mo., Ill., Ky., Ind., and Ohio).

Oct. 1-2—Portland, Oreg. (Wash., Oreg., Calif., Ariz., Utah, Nev., and Idaho).

Oct. 8-9—Denver, Colo. (N. Dak., S. Dak., Nebr., Kans., Okla., Tex., N. Mex., Colo., Wyo., Mont.)

Oct. 15-16—New Orleans, La. (N. C., Tenn., Ark., La., Miss., Ala., Ga., S. C., Fla.)

Oct. 22-23 — Philadelphia, Pa. (Mass., Maine, Vt., N. H., Conn., R. I., N. Y., N. J., Pa., Del., Md., Va., W. Va.).

Basal Plant Density Guide To Protecting Highways—Other Slopes

By William L. Smith

SPEEDED-UP construction of highways in all parts of the country brings the matter of stabilizing earthen slopes and cuts into sharp focus as a national problem. So, too, does the building of such other conservation structures as flood-prevention dams and reservoirs.

The Soil Conservation Service has been concerned with this problem on the small dams constructed to help prevent floods. In Texas alone, more than 600 small dams have been built since 1954. As a result, rapid progress has been made in the techniques of planting and followup treatment to promote the growth of grass on such sites, though the advancement in management and maintenance knowledge has not been so rapid.

To find out how much grass was necessary, and how dense the cover should be to give protection—or its most desirable basal density—the Service made a field evaluation. Measurements were made on flood-prevention structures, and on embankments of farm ponds, lakes, and levees that already were vegetated. In each instance, the cover had given excellent protection for several years. The structures chosen met the following requirements:

(1) Soil erosion was controlled, and there was no active gullying, rilling, or excessive loss of topsoil. (2) There was enough cover (grass and litter) to prevent damage from a heavy rainstorm. (3) All structures selected for the evaluation were properly grazed or mowed, and weeds were controlled.

Desirable adapted plants with sufficient vigor to endure under proper management were identified for the various areas. A quadrat analysis method was used to determine the percentage of basal density. The top growth and effective litter were clipped and weighed to get a correlation between basal density and pounds of cover.

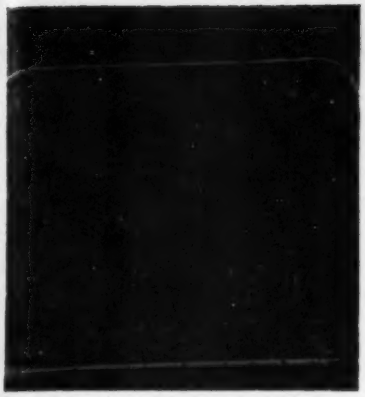
For the 17- to 19-inch rainfall area, high lime soils over limestone and sandy soils, with an average winter temperature range of 36° to 46°, the grasses furnishing the best protection were side-oats grama, little bluestem, plains bristlegrass, Indian grass, switchgrass, blue grama, Caucasian bluestem, and KR bluestem in the warmer part. A minimum of 14 percent basal density of stands composed of one or more of these grasses yielded a satisfactory cover. The system of management called for no grazing, except as needed for the benefit of the grass.

On heavy clay and sandy soils over limestone, shales, and sandstone in the 20- to 30-inch rainfall belt, with an average temperature of 44°, KR bluestem, green sprangletop, plains bristlegrass, side-oats grama, and little bluestem proved best adapted. A minimum of 14 percent basal density of a mixture of three or more of these grasses was sufficient cover.

In a large area of high lime soils in the 25-inch rainfall area with average winter temperature of 61°, good plants for giving soil protection and livestock feed were Medio bluestem, buffelgrass, Kleberg

Buffelgrass on 2:1 slope measured for basal density.

Note:—The author is management agronomist, Soil Conservation Service, Denton, Tex.



Basal density here measured 77 percent.

bluestem, side-oats grama, plains bristlegrass, and four-flower trichloris. A minimum of 18 percent basal density of mixtures of these grasses gave a satisfactory cover.

Bermudagrass, a turf grass, was used in areas of more than 30 inches annual rainfall, with an average winter temperature of 44° to 55°. A minimum of 40 percent basal density of bermudagrass gave a satisfactory cover on embankment slopes and spillways from crest to the outlet end. On forebays, cut slopes, and noncritical areas, a basal density of 30 percent of bermudagrass gave a sufficient cover. Bunch grasses in this rainfall area—such as KR bluestem, switchgrass, side-oats grama, little bluestem, and Texas wintergrass—were used on some sites. A basal density of 20 percent of these grasses gave sufficient protection.

Basal density of adapted desirable grasses seems to be a good criterion for determining when a satisfactory cover of grass is established on slopes requiring a cover of grass for protection against water erosion. As soon as all critical areas of the structure have a minimum percentage of basal density of acceptable grasses, as set forth in the criterion, and erosion is controlled, the cover is considered satisfactorily established.

In addition to the use of basal density as a criterion in the area of heavy clay soils over limestone and sandy soils over sandstones in the rainfall area of 20 to 25 inches, with an annual mean temperature of 44°, 2,500 pounds air-dry weight of the adapted grasses was approved as an alternate standard for bunch grasses.

For sites on heavy clay soils in the 17- to 19-inch rainfall area with a mean annual temperature of 46°, nine established plants to the square yard were approved as a satisfactory cover. They included side-oats grama, blue grama, green sprangletop, KR or Caucasian bluestem, cane bluestem, plains bristlegrass, and Texas wintergrass. No consideration was given to low order perennials and annuals, but their presence was expected to increase the effectiveness of the cover.

Erosion Control On D. C. Loop, Too!

Administrator Donald A. Williams sees in a piece of roadside conservation work just across the street from his office in the U. S. Department of Agriculture's "South Building" one more dramatic example of the results of a quarter of a century of encouragement of highway protection by the Soil Conservation Service in cooperation with Federal and State highway agencies.

After fretting for a year or more about the eroding banks of a cut leading into the 12th Street tunnel under Washington's historic Mall, he and his staff were pleased to see protecting sod laid on the banks as soon as the paving had been finished, and well before this key link in the capital city's new inner-loop beltway was opened to traffic.

Spreading topsoil, fertilizing, and sodding is being extended progressively to the slopes of other underpass and elevated roadway approaches in the Southwest Freeway maze as fast as construction work is completed on different sections. (SEE COVER PHOTO.)

This effective highway conservation work provides pleasing view for SCS people from USDA South Building (l. background). Flags flew opening day.

Conservation for Bet

By Donald Wil

Donald A. Williams.

ONE of the miracles of 20th Century America has been the long way we have come in road building and maintenance. And it has been a long way to our day of superhighways from that time, a half a century or less ago, when township farmers got together with their teams, scrapers, and drags during good-weather lulls in the cropping season and "worked" the dirt roads.

One of the significant aspects of the evolution of modern highway planning and construction has been the growing attention to roadside erosion control, stabilization, and beautification. For example, when I started out in highway work, no one realized there was such a problem as roadside erosion. Information was not available to road builders on soils or soils mechanics, erosion, and other factors that today are commonly taken into account by highway bodies. That was in 1924 when, fresh out of high school, I carried the chain and ran the rod on roads in northern South Dakota for a brother who had an engineering firm.

The same situation largely prevailed during my later work as engineer with the South Dakota Highway Department before coming with the Soil Conservation Service in 1935. The State today has one of the outstanding highway conservation programs in the country.

The Service, in seeking to put a stop to roadside as well as farmland erosion, and to resulting costly road maintenance, called the attention of highway builders to some of the techniques of slope protection, water disposal, and other measures that now are in such widespread use. In fact, while I was SCS project engineer at Dayton, Wash., in 1938-39, we launched one of the earlier formal highway pilot erosion control projects in the country, just outside of Walla Walla, in cooperation with the U. S. Bureau of Public Roads and the State Highway Department. We were demonstrating some of the principles later adopted as standard practice.

The Bureau, which also already had been interesting itself actively in this new aspect of road building, from those early conservation days on gave increased national leadership to the erosion-control program in the Federal aid highway system. It has done a marvelous job.

Through these cooperative Federal-State-local efforts, roadside protection and beautification may be seen today from one end of the country to the other—on interstate turnpikes, State highways, or farm-to-market roads. Although the Soil Conservation Service can, I think, properly take credit for helping to get this important activity started, it is more significant that it is the public roads and State highway people who now are effectively putting the program into practice themselves.

More and more of our technical assistance now is centered on

Protected roadbanks like this one near Ritzville, Wash., stretch for uncounted miles over the country's horizons.

Note:—The author is administrator, Soil Conservation Service, Washington, D. C.

t'e Roads Moves Ahead

Donald Williams

Recreation for all and pleasant stops for travelers are among dividends of highway conservation measures like this roadside pond near Bel Air, Md.

county and township roads, where erosion and water management is a real problem, but where local authorities do not have the facilities that the State and Federal highway agencies have. The Service provides this help through soil conservation districts and through local small-watershed projects, because the problems of roadside and adjacent farmland erosion and dealing with them are interrelated.

The Service also gives technical advice to local planning and other bodies that request counsel on coping with increasingly troublesome highway erosion and water problems in built-up rurban areas. Of the Nation's total of 3½ million miles of roads and streets, about 2¾ million miles are other than State or Federal roads.

In any case, watershed protection and flood prevention is of special importance to protection of our roads and highways. Roads and bridges are among the heaviest casualties when streams flood lowlands or heavy rains wash soil off of adjacent lands onto roads.

Total nonagricultural damage for 361 planned watersheds on which figures are available is nearly $6½ million a year, a substantial portion of which is to roads and bridges. The land treatment and flood prevention treatment measures employed in watershed conservation are designed to halt or greatly reduce such flooding and sedimentation, and roads benefit accordingly.

In addition, many watershed plans include direct protection of roadside ditches, cuts, fills, and shoulders to protect them from erosion and to prevent sediment from being delivered from roadsides into the watershed channel system to create further sedimentation damage downstream. To July 1, 1961, a total of 4,200 miles of such roadside erosion control had been carried out in watershed and flood prevention projects alone.

As a representative example, approximately 150 miles of roadside erosion control is being established in the Muddy Creek watershed in McDowell and Burke counties in North Carolina by the State Highway and Public Works Commission with seed, fertilizer, and plants provided from Federal watershed funds. Untreated roadbanks are one of the major sources of sediment in this watershed.

One of the most important, and popular, contributions the SCS makes to highway erosion control programs is the supplying of soil survey information. The Service collects soil samples, as part of its regular surveys, and sends them to the Bureau of Public Roads, which makes engineering tests itself or through 30-some State highway department laboratories. The data are used both by the Bureau and the State highway departments in highway planning and design.

Availability of this information to highway people has saved them untold amounts of money, in such items as determining most suitable road locations from the standpoint of adequacy of subgrade for yielding construction material without more costly "borrowing" and

One way of getting the job done—building structure to prevent sloughing of highway bank on Route 9 near Cummington, Mass., in Berkshire SCD.

hauling by the contractors. O. L. Lund and O. B. Griess of the Nebraska Department of Roads have expressed it this way:

"The Department makes rather extensive use of the agricultural soil maps which are published by the Conservation and Survey Division of the University of Nebraska and the U. S. Department of Agriculture. It has often been said that this group of maps is one of our most valuable aids for soil survey and materials prospecting work. A tremendous saving in time and money has been effected in the past 20 years through the daily use of these maps."

The SCS, on the other hand, uses the Bureau of Public Roads engineering test data in connection with construction of dams and other structures and, more recently, in determining suitability of soils to support housing and other developments in urban areas; and incorporates the information in all of its present-day soil survey reports.

Improved safety is another product of highway conservation, along with its economic and other benefits. As a result of prevention of road flooding, earth slides, and other hazardous conditions, highway accident tolls can be, and frequently are, measurably reduced. Even seeding grass along the edge of the pavement—not just on cut banks and fills—results in safer road shoulders, as well as providing erosion control and beautification.

Specially designed structures, adapted grasses, trees, and shrubs, and other conservation "tools" are used in the accelerating program of protecting and improving the country's highways and byways. Some of them are illustrated by articles in this issue of SOIL CONSERVATION. Each one has its place. Used together, they are getting a highly important job done.

Roadside Erosion Control *At Air Force Academy*

By Robert K. Griffin

ROADSIDE conservation measures have restored scar areas to their original natural beauty on the Air Force Academy lands north of Colorado Springs in Colorado.

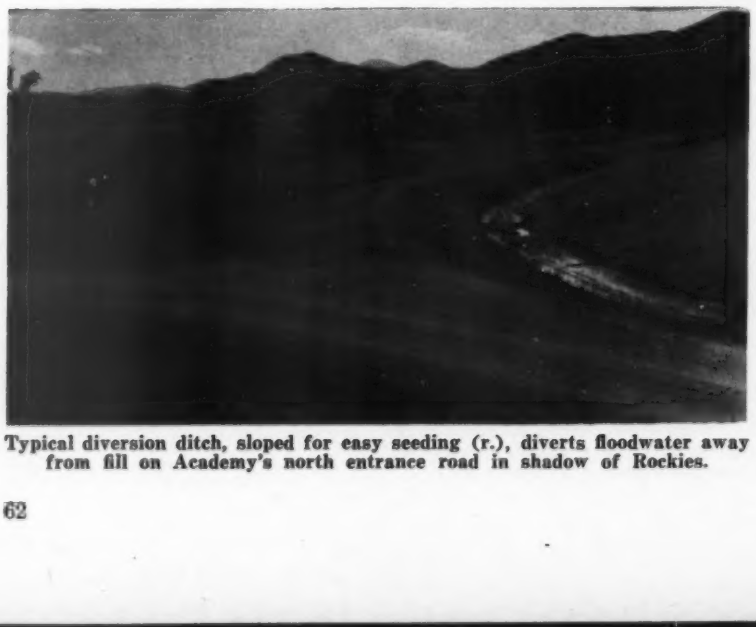
A drive through the area attests to the fact that roadside cut and fill scars can be treated to stop erosion, and that the erosion-control structures can be blended into the landscape, too, if they are laid out and built carefully.

A factor in the selection of the site for the Academy work was its scenic beauty. Towering mountains form a natural, majestic background. Pine-clad hills, skirted by valleys of grass, blend into a wide rolling grassland.

But it was inevitable that construction of the major roads would destroy much of this beauty. In addition, erosion of the scar areas would add to the problem.

Realizing what it was faced with, the Air Force Academy Construction Agency called upon the Fountain Valley Soil Conservation District for help. Before long, the district had a team of Soil Conservation Service men stationed at the Academy. Their task—to stop the erosion along the roadsides and to revegetate the ugly scar areas.

The original road construction plans had called for cut and fill slopes to be left on a 2 to 1 plane; but it is virtually impossible to vegetate slopes this steep in an area of only 16 inches of annual precipitation. Therefore, the first step in erosion control was to flatten the slopes to at least 4 to 1. As this was being done, the longer slopes were benched, a process which involved building graded diversions across the slope to carry floodwaters away from the scars.



Typical diversion ditch, sloped for easy seeding (r.), diverts floodwater away from fill on Academy's north entrance road in shadow of Rockies.

Note:—The author is work unit conservationist, Soil Conservation Service, Colorado Springs, Colo.

Better Plants For Raw Banks

By R. B. Thornton and C. L. Williams

Some rills were 2 feet deep on this slope after only 2 years.

Here, slope has been flattened, protected by ditches above, and trees planted on it.

Ditches were built at the top of the cut slopes to intercept and divert any water that might have concentrated on the slope itself.

Topsoil, stockpiled during road construction, was used to plate the entire disturbed area. To protect the slope during grass establishment, straw mulch was spread on the topsoil, held in place by crimping it into the soil. The last operation was to drill the grass seed.

Because of their position, some roadside slopes could not be flattened appreciably; and, because they were too steep for equipment use, seed was broadcast, and straw was held in place with wire mesh.

Two years of above-normal precipitation has resulted in good stands of grass on many of the scar areas. Diversion ditches have controlled floodwater. Today, much of the roadside area appears never to have even been disturbed.

MILLIONS of acres are being stripped of their protective vegetative cover each year in the process of building highways, military installations, airfields, dams housing developments, and other large-scale construction projects.

Although all this acreage does not fall into the category of critical erosion-producing areas, much of it does, including denuded portions which are inaccessible and are difficult to seed, fertilize, and manage. Among the critical areas are cut and fill slopes, constructed barricades, waterways, earth dikes, and portions of airfields.

Initial establishment of an effective cover for these areas has its own problems. Maintenance of this cover more often than not, with respect to the cost factor, becomes the major problem.

Horticultural literature always instructs the gardener to condition his soils to the needs of the plant. This is hardly a sound proposition with the acreages involved in this problem. The approach, therefore, must be that of finding the plants which will grow and persist on the various soils and exposures with the minimum of adjustment of lime and fertilizer applications. To do this we must recognize the stages in the ecological succession of plants in the area involved. It

Note:—The authors are, respectively, manager, Plant Materials Center, and plant materials technician, Beltsville, Md., both of the Soil Conservation Service.

This U. S. Navy photo shows a slope at the Propellant Plant at Indian Head, Md., protected by year-old fescue and crownvetch.

means that we must return to an early stage in the succession of plants and select the pioneer types which can and do find themselves at home on these raw banks.

The highway departments are heavily involved. The projected new interstate highway system alone calls for 41,000 miles of modern highway construction. Ordinary first class highways require 25 acres or more to the mile; whereas many of the superhighways like the Pennsylvania and Ohio turnpikes require more than 50 acres a mile. A fair percentage of this land has to be revegetated and maintained. The task is getting so big that already highway engineers and maintenance men are looking for ways to reduce their maintenance costs:

The plants most widely used at present are selected from crops developed for forage production. Use of this type of plant has many times resulted in failures, and the resulting covers usually require an expensive maintenance program of fertilization with repeated mowings. Often, they revert back to a lower order of plants, most of them undesirable.

During the fall and winter of 1959-60, the National Plant Materials Center of the Soil Conservation Service at Beltsville, Md., in agreement with the Department of the Navy, initiated a study of low-maintenance ground covers. After an initial screening of more than 120 selections representing 55 genera, a few were planted on exposed subsoil sites, including areas where previous seedings of forage crop species had failed. Some trials involved spaced plantings to study rapidity of cover growth. Other trials involved direct seedings.

Although the duration of the project has not been sufficiently long to answer accurately many questions, some guidelines are evidenced: Expensive topsoiling and seedbed preparations are not mandatory to the success of seedings on exposed subsoil sites or constructed

Lespedeza and ryegrass protecting treated slope section.

earth embankments, if the correct species of plants are employed. Fertilization for transplanted materials should be under the plant rather than broadcast over the area as applied with seedings.

A few plants such as carpet bugle (*Ajuga reptans*), wichura rose (*Rosa wichuraiana*), drug speedwell (*Veronica officinalis*), mother-of-thyme (*Thymus serphyllum*), and lilyturf (*Liriope graminifolia*), are showing much promise toward providing the desired cover. They will probably have to be supported by a temporary companion crop until they spread sufficiently to fill the spaces between plants.

Combinations of cool-season and

Wichura rose 3 months after planting on mulched bank.

warm-season grasses and legumes which should provide an effective winter-summer green cover, thus providing a low fire hazard, appear feasible. Species which appear promising for the climatic zone involved—parts of the Piedmont and Appalachian zones—are red fescue, Canaia bluegrass, several lespedeza species, small burnet, and crownvetch.

The species may change with the plant growth zone involved, but with mulching, fertilization, liming, and cognizance of the slope's aspect, effective vegetative covers are obtainable in most places if species are selected from the group of plants that may be called "the pioneer group."

Considering the cost factors involved in direct planting as compared to transplanting of plants, it becomes quickly obvious that the operations involved in direct seedings will be cheaper. In the direct seedings used, the rates per acre went from a high of 60 pounds to a low of 25 pounds. By the same token, when using plants, the farther apart they can be placed and the greater the rate of spread obtainable, the lower the initial cost will be. Thus a 2- by 2-foot spacing would require approximately 10,900 plants per acre, a 3- by 3-foot spacing 4,840 plants, and a 4- by 4-foot spacing would require only 2,700 plants.

Work is continuing on all these aspects of the direct plantings and seedings with a view to speeding up to the extent practicable the use of these techniques in helping to deal with a growing problem.

Have You Seen?---

● "Rural Areas Prosper Through Small Watershed Program," released by USDA as Picture Story 138. This pamphlet shows graphically how the watershed projects benefit varied individual and community interests.

Pesky Weeds Licked

As Roadside Problem

By Robert F. Tegner

(Note: Idaho in 1939 was one of the earliest States to undertake a highway erosion-control program in cooperation with the Soil Conservation Service and others concerned with such problems, including those of weed control. Your editor knows, because he was there and wrote stories about that pioneering highway conservation work!—Editor.)

WIND and water have taken their toll on Idaho highways —especially in the construction stage—but the weeds that come in to take over have been just about as pesky!

Happily, however, cooperative work of the Idaho Department of Highways, soil conservation districts, and the Soil Conservation Service has been writing an erosion and weed-control success story in Idaho for nearly a decade. Consultation between the SCS and the Highway Department had gone on for a decade and a half before the farmers' and ranchers' districts formally entered the field.

Highways are costly enough without having to "doll them up," and Idaho engineers were pressed to make highway dollars produce as much roadway as possible. But as wind, water, and weeds wreaked havoc with soil and scenery, it became increasingly obvious that something more than "dolling up" was needed.

In 1953, noxious weeds, which nearby farmers were fighting in their fields, were plaguing the Idaho Highway Department, especially along a stretch of Highway 30 North between "I Go Pass" and Pocatello. Knowing from past consultation that the SCS had the technical answers to such problems, highway engineers turned to it again for help.

As a result, the Power Soil Conservation District agreed to eradicate weeds and seed the right-of-way with its own equipment and supplies, at cost. A formal agreement was signed—the first of many which have been executed in the 9 years since.

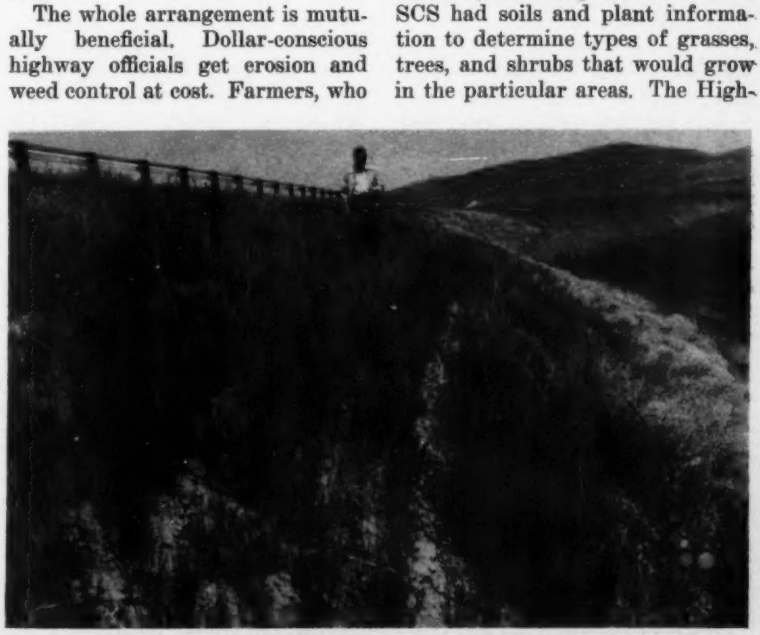
From this first contract came a sample cooperative agreement form, including specifications, species, seeding rates, fertilizer, and other pertinent items, prepared for use by other soil conservation districts and the Idaho Highway Department.

"The idea has spread, also, to districts and highway departments in adjacent States," SCS State Soil Conservationist Luther Jones said.

The whole arrangement is mutually beneficial. Dollar-conscious highway officials get erosion and weed control at cost. Farmers, who are trying to rid their fields of weeds, can be confident the State is doing likewise along highway rights-of-way; and they share with others of the motoring and taxpaying public the pleasure of highways that not only look better but cost less to maintain.

Roy Harden, assistant chief of the Highway Department's design section, said difficulties encountered where timing or other circumstances prevent immediate seeding only serve to demonstrate the effectiveness of the control program elsewhere. Fifteen to 20 percent of some fills have been eroded by winds whipping the fine-textured soil where control measures could not be initiated in time to prevent it.

The Department has been consulting with SCS personnel since the '30s, Harden pointed out. The SCS had soils and plant information to determine types of grasses, trees, and shrubs that would grow in the particular areas. The High-



2-year-old stand of alfalfa and grass on steep fill in East Side SCD.

Note:—The author is information specialist, Soil Conservation Service, Berkeley, Calif.

The Gooding SCD made this highway erosion control crested wheatgrass planting with its own equipment.

way Department on its own, with advice from the SCS, has seeded more than 5,000 acres of borrow banks, and fills.

Most seedings have been crested or sodar wheatgrass. In addition to the seeding, straw mulch has been applied in many areas, at a rate of 2 tons to the acre, along with 200 pounds of 16-20-0 fertilizer. The seed sometimes is drilled through the mulch. The program also has included experimental shrub and tree plantings.

Erosion and weed control now have earned a significant place in Idaho's highway plans. As a result, more and more of the State's modern ribbons of concrete and macadam are flanked by banks of vegetation, eliminating scars which for years made conservationists and highway engineers shudder—along with the motoring public.

West Virginia Road Commission

Sets Conservation Pattern

By Norris R. Caryl

THE State Road Commission of West Virginia is playing a key role in making the small-watershed program a reality in the eastern part of the State. Cooperating with the five-county Potomac Valley Soil Conservation District, the Road Commission has become a full-fledged partner in the flood-prevention programs in the Upper Potomac River Basin.

Two 50-year contracts are the basis for this unique partnership between the Commission and the U. S. Department of Agriculture. In them, the State Road Commission accepts full responsibility for maintenance of 58 retarding dams and some 4,500 feet of stream channel.

These structural works of improvement are part of the small-watershed programs developed for the South Fork River and Patterson Creek. The South Fork is a 185,000-acre watershed in Highland County, Va., and in Hardy and Pendleton counties in West Virginia. The 182,000-acre Patterson Creek watershed lies in Grant and Mineral counties, W. Va. Total installation cost for each program exceeds $5 million.

Federal technical and financial help for development of these watershed programs was provided through the Soil Conservation Service. Local costs are principally for obtaining easements, rights-of-way, and for operation and maintenance of the completed dams and stream channel.

Financing of local responsibilities was a problem; but financing the estimated cost of $339,460 for easements and rights-of-way for all structures in both watersheds was worked out through donations and contracts. Ten-year contracts were executed between the Potomac Valley District and the county courts of Hardy, Mineral, and Pendleton counties and the Town

Earth spillway of dam in South Fork watershed on Rt. 33 east of Brandywine, W. Va.

Note:—The author is area conservationist, Soil Conservation Service, Romney, W. Va.

Flood-prevention dam in New Creek watershed is seeded to birdsfoot trefoil and tall fescue.

of Moorefield, for a total of $60,000. A plan to finance maintenance of all structural measures, at an estimated annual cost of $11,200, was more difficult to attain. In the early stages of developing the plans. it became apparent that State roads, bridges, and culverts were one of the major items of flood damage, of an average annual damage to State road property of $276,915 in the two watersheds. The watershed work, when completed, would reduce this to $95,284, or an annual savings to the State Road Commission of $181,631. The average annual cost of $11,200, added up to an attractive return of $16 for each dollar of cost.

The local finance committees contacted county and district State road commission officials. They were interested and eager to cooperate. As expressed by one commission official: "It was just good business, and an opportunity for the State Road Commission to be of greater service to the local people."

Working out all the details of the maintenance plans and contracts included many legal problems, such as the legality of the State Road Commission's entering into such a contract with the Potomac Valley District, all of which were solved. For example, included in the proposed contracts between the State Road Commission and the District was this provision:

"The Potomac Valley Soil Conservation District agrees that all works of improvement will be covered by legally recorded easements in favor of the District which will permit the State Road Commission of West Virginia ingress and egress to and on the sites of works of improvement for inspection and maintenance purposes."

After months of work, on August 14, 1958, a 50-year maintenance contract for the South Fork watershed between the Potomac Valley district and the State Road Commission was approved and executed. A similar contract for the Patterson Creek watershed was executed in March 1962.

The execution of these contracts represents a $560,000 obligation by the State Road Commission over a 50-year period. It made possible the start of two $5 million flood-prevention programs, with annual average benefits of $612,020 to the people in the watersheds, county, and State. Both programs have been approved by the U. S. Army Corps of Engineers. They have been made an important part of the Corps' recently recommended Comprehensive Plan for the Development of Water Resources of the Potomac River Basin.

The going South Fork and Patterson Creek small-watershed programs are examples of cooperation between local, State, and Federal agencies, and the people living in the watersheds. All played an important part. For the first time, the State Road Commission has formally accepted a major and vital part in the small-watershed program in West Virginia. It is doubtful that these programs would be under way without this support.

Ready for seeding, highest earthfill dam (88 ft.) built with SCS help in W. Va., in Potomac Valley SCD and New Creek watershed, protects town of Keyser.

Fertilized Native Plants Promise Quick and Cheap Roadbank Protection

By E. C. Richardson and E. G. Diseker

RESEARCH at the Coosa Watershed Research Project in Georgia is showing that fertilizer and lime will encourage naturally seeded native plants. This finding is significant as an inexpensive means for reducing erosion. Fertilizer and lime can be easily applied on existing county and State roads where high costs of vegetative establishment by other means may be prohibitive.

Observations of unvegetated roadbanks in the Piedmont area of Georgia showed many native species actually had established themselves, although they were so small and impoverished that it was hard to see them. In such a state of arrested development, they gave no protection against erosion. As a result, the roadbanks eroded badly, creating sediment problems in streams and reservoirs, causing traffic hazards, and greatly increasing the cost of roadside maintenance.

The impoverished native species found on the roadbanks in the Georgia area, around Cartersville, were broomsedge, beggarweed, perennial lespedezas of both upright and trailing type, and several others. Discovery that native species offered real promise resulted from a series of experiments devoted largely to determining the value of various domesticated plant species for roadside revegetation.

In these experiments, a complete fertilizer was applied, along with lime, and with and without surface mulches. Wherever the planted domesticated species failed because of low winter temperatures, high summer temperatures, or late plantings of warm-season species, the native vegetation came in. Furthermore, treated but unseeded check plots soon produced a flourishing growth of native species which rapidly stabilized the area.

The responses of the native species to soil fertility treatments were so great that a separate study on fertilizer rates was initiated. Experiments were laid out in which 4-12-12 fertilizer was applied at rates of 0, 250, 500, 1,000, and 2,000 pounds an acre, with 2 tons of lime an acre, and worked into roadbank surface where improverished plants already grew. The initial fertilizer treatments were applied March 11, 1958. Nitrogen was applied, at the rate of 50 pounds of N an acre, in June 1958.

Maintenance fertilizer treatments in 1959 consisted of 250 pounds of 4-12-12 an acre to plots which received the same amount in the initial application. All other plots were fertilized with 500 pounds of 4-12-12 an acre in March 1959. Nitrogen was applied again in June 1959, at the rate of 50 pounds of N an acre.

Brush and rough plants were removed once during the growing season. Native cover species were never cut. They were allowed to make maximum growth during the frost-free growing season to produce seed which shattered on the land. The standing plants acted as a trap for seed moved by wind.

All of the different rates of 4-12-12 plus nitrogen resulted in vigorous growth and development of the native species as a protective cover on the lower two-thirds of the bank the first growing season after fertilizer treatment. During the second growing season, the cover extended up the bank and filled much of the remaining open area with new seedlings. With the ex-

Roadside bank before treatment.

Note:—The authors are soil scientist and agricultural engineer, respectively, Soil and Water Conservation Research Division, Agricultural Research Service, Cartersville, Ga.

After treatment without seeding: Center plot not fertilized; right plot received 2,000 lbs. per acre of complete fertilizer and lime and nitrogen, and left plot 250 lbs.

ception of the check plots, 250 pounds of 4-12-12 plus nitrogen treatment produced the poorest cover. The 1,000 pounds of 4-12-12 plus nitrogen was almost as good as the 2,000 pounds an acre rate but not much improved over the 500 pounds an acre rate.

Broomsedge and poverty grasses were the predominant native species that developed during the first 2 years. Their seeds were probably transported by the wind much easier than the heavier seeded species, such as native perennial lespedeza. A cover of honeysuckle, dewberries, and other native species also developed as a result of fertilizer application.

It appears that roadbanks may be conserved quickly and cheaply in the Southern Piedmont by applying 500 pounds of 4-12-12 fertilizer an acre from February to May, followed by 50 pounds of N an acre in May or June. In all probability, these results with native species could be duplicated in many other areas, but only those areas with a fair stand of native plants should be so treated. Areas totally void of vegetation should be completely seeded. Generally, the areas that can be stabilized by fertilizer treatments only will be found along the older roads.

On very steep roadbanks with 1 to 1 or 2 to 1 slopes, it is essential to mulch the surface to hold the fertilizer and lime until vegetation can be established.

No. 69

This is the sixty-ninth of a series of articles to appear from time to time in explanation of the various phases of research being conducted by the Department of Agriculture on problems of soil and water conservation.

Maryland Highway Conservation Provides Scenic Recreation Spots

By Lester Fox

THE Maryland State Roads Commission provides more than smooth highways on which motorists can glide safely and smoothly. It is at the same time furnishing a pleasantly scenic background and roadside facilities for recreation.

Take State Highway 22, for example. When plans for its improvement were made a few years ago, the roads commissioners kept scenic beauty and recreation in mind. They frowned on commercial advertising along the route. They looked for suitable sites for farm-type ponds.

Soil Conservation Service technicians found a pond site just a mile from the center of Bel Air, a growing community bulging with an influx of new residents from Baltimore. It was a swampy area

Children have fun fishing in Westminster community pond.

Note:—The author is field information specialist, Soil Conservation Service, Upper Darby, Pa.

Westminster community pond in setting of countryside, highways, and city.

at the edge of the highway on a farm owned by the Joseph N. Umbarger estate, a cooperator of the Harford Soil Conservation District. The estate gave 5½ acres to the State. There was no intention of gaining any benefits from the gift; but, when the SCS-designed 1⅓-acre pond was finished, it drained the farm's wet spot. Cows now graze those 3 or 5 extra acres that before were idle and were not even used by waterfowl or other wildlife.

The main thing, though, is the recreational use that the people of Bel Air get out of this conservation pond. Go there around 5 o'clock any summer afternoon, and you'll see families gathering for picnic suppers in cool, pleasant surroundings. And on any warm, sunny day, year-round, you'll see families enjoying an outdoor meal at the side of the attractive pond.

About 600 people find pleasure each month at this pond during the warm half of the year. Come winter, and the pond beckons to the skaters of Bel Air—more than 4,000 of them during the season.

Skip over to Westminster and you'll find the same thing: A highway farm-type pond serving the outdoor recreational needs of this community of 10,000 persons.

Before these ponds were put into the State highway scheme of things, the people had a long way to go for outdoor recreation. At the Bel Air pond a rustic sign says:

Bynum Run Picnic Area
And Community Pond
State Game and Inland Fish
Commission
State Roads Commission

The Roads Commission built the pond, local contractors doing the work. The commission also planted trees, shrubs, and grass around the pond, and maintains the property. The State Game and Inland Fish Commission chipped in some cash to help pay for the pond, and stocked it with bluegills and bass.

The Izaak Walton League fenced the pond site on three sides, leaving the area bordering the highway open. It also built two large fireplaces, which are supplemented by a number of small grills. Yearly, during Maryland's "Land Week," sponsored by the Maryland Association of Soil Conservation Districts and cooperating agencies and conservation organizations, the League holds a gathering on the site.

The Lions Club put in floodlights to illuminate the place at night. Elsewhere in Maryland, other service clubs have helped in similar recreational developments. Always there has been a community of interests working together for the common good, with the State Roads Commission keeping an eye out for recreational sites along its extensive highway system.

Bynum Run community recreational pond draws picnickers, fishermen, skaters —and ducks!

County Builds Road To Serve Watershed Project

By Roy M. Davis

WHAT is considered to be the largest floodwater-retarding structure in Kansas created a road problem on the Aiken Creek Pilot watershed. But the county commissioners cooperated with the Chautauqua County and Montgomery County soil conservation districts, the project sponsors, in solving it.

During the planning stage, with help of the Soil Conservation Service, it was determined that the single pilot watershed structure would back water over a road during medium to high levels of the flood or detention pool. This road was an important outlet for a few families. Heavy rains could cause it to be under water for several days.

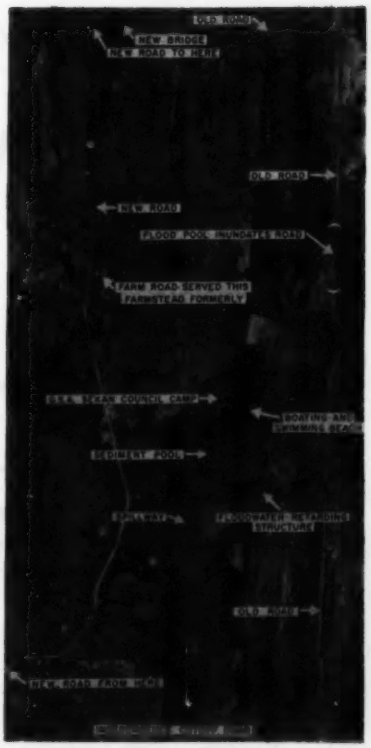
The district supervisors saw that this prospect could block the pilot project; so they suggested to the county commissioners and engineer that either a high bridge and fill be built or that the road be rerouted on the other side of the reservoir. Although the county engineer considered both suggestions to be too expensive, the supervisors emphasized to the commissioners the value of the flood-prevention measure, and the need for a demonstration project; and it was decided to reroute the road at county expense.

When the floodwater-retarding structure was completed, it had a sediment pool surface area of 31 acres and a flood pool surface area of 214 acres, with a total capacity of 2,736 acre-feet. Soon after its completion the rerouted road also was finished. This road project consisted of about 2 miles of new grading and graveling. The cost to the county was about $17,500. The county commissioners agreed to leave the old road open and to maintain it for use during low-water stage. A large sign was erected on the road on each hill bordering the creek to warn travelers of high water after heavy rains.

Stretch of the new road.

Sign warns travelers of old road.

The whole undertaking was a demonstration of community and county government cooperation to get a watershed project installed. The success of the project and the benefits it has brought testify to the sound wisdom in the conservation planning.



New road (l.) and old road (r.) in this Aiken Creek pilot watershed mosaic.

Have You Seen?---

● "Agricultural Land Resources—Capabilities—Uses—Conservation Needs," published by USDA as Agriculture Information Bulletin 263. This bulletin gives a digest of the National Inventory of Soil and Water Conservation Needs on private agricultural land, with charts and maps portraying the major findings.

◆

Those using weedkillers should follow spraying procedures that help confine tiny weedkiller particles to the sprayed area.

Note:—The author is area conservationist, Soil Conservation Service, Emporia, Kans.

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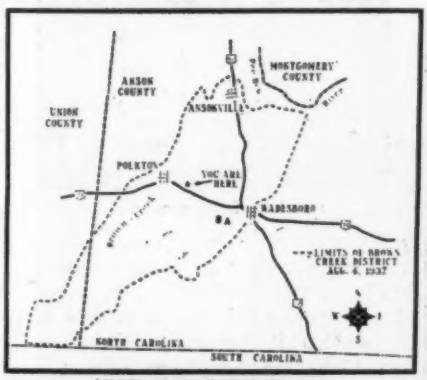
HISTORICAL MARKER

THE BROWN CREEK SOIL CONSERVATION DISTRICT-FIRST IN AMERICA

Here was established the first district in America for a systematic program of land erosion control. Known as the Brown Creek District because it embraced the area of the Brown Creek Watershed, it heralded the beginning of a national program of soil conservation districts.

The Brown Creek District included the plantation birthplace of Hugh H. Bennett, "father of soil conservation" (A). Bennett, born in 1881, graduated from the University of North Carolina in 1903, and became a soil surveyor in the Bureau of Soils, Department of Agriculture. Observing that soil erosion ruined much good land throughout the United States, Bennett slowly initiated a program to prevent this waste. On April 27, 1935, Bennett became director of the Soil Conservation Service, a position which he held until his retirement in 1952. By this time soil conservation was a national concern, largely because of the work of Hugh Bennett and his associates.



The success of the soil conservation district program was due to local participation by farmers and landowners. Conservation districts were created throughout the United States. Bennett and his specialists worked with the farmers in the districts for an effective program.

The Brown Creek District was established in 1937. In May thirty local property-owners petitioned the State Soil Conservation Committee "That there is need, in the interest of the public health, safety, and welfare, for a soil conservation district to function in the territory hereinafter described." The district would embrace 120,000 acres, much of it badly eroded. The petition was approved on May 31. A public hearing, held on July 3 at Wadesboro and followed by the mailing of ballots to the local farmers, resulted in an overwhelmingly favorable vote for creating the district. The North Carolina Secretary of State issued a certificate setting up the district on August 4. The Brown Creek District became the example for districts of the future.

This large metal tablet on U. S. Highway 74 in Anson County, N. C., in memory of Dr. Hugh H. Bennett and commemorating the Nation's first soil conservation district (Brown Creek) is one of several historical markers erected by the North Carolina State Highway Department. It was dedicated August 7, during a tour by the district supervisors and others attending the National Association of Soil and Water Conservation Districts southeastern area meeting at Durham. On the same day, a monument commemorating the first soil conservation district plan was dedicated on a plot of ground donated to the national association by the widow of Dr. Furman Y. Sorrell, who was the first cooperator with the Brown Creek district. The group also visited the Bennett homestead, which may be considered for designation as a national historic shrine to the man who, as the sign indicates, became known as the "father of conservation."